1. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 15x^3 + 56x^2 + 60x + 16$$

A. $z_1 \in [-2.37, -1.82]$, $z_2 \in [-1.6, -0.7]$, and $z_3 \in [-0.66, 0.01]$

B. $z_1 \in [-3.12, -2.21]$, $z_2 \in [-2.2, -1.8]$, and $z_3 \in [-1.16, -0.73]$

C. $z_1 \in [0.04, 0.25]$, $z_2 \in [1.5, 2.3]$, and $z_3 \in [3.59, 4.28]$

D. $z_1 \in [0.28, 0.66]$, $z_2 \in [0, 1.8]$, and $z_3 \in [1.8, 2.27]$

E. $z_1 \in [0.58, 0.8]$, $z_2 \in [1.5, 2.3]$, and $z_3 \in [2.39, 2.55]$

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2. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{4x^3 - 28x + 29}{x + 3}$$

A. $a \in [-13, -6], b \in [33.5, 37.2], c \in [-136, -135]$, and $r \in [434, 440]$.

B. $a \in [-3, 7], b \in [-16.3, -15.4], c \in [34, 40]$, and $r \in [-115, -110]$.

C. $a \in [-3, 7], b \in [11.9, 14.4], c \in [2, 15]$, and $r \in [50, 60]$.

D. $a \in [-13, -6], b \in [-38.6, -35.7], c \in [-136, -135]$, and $r \in [-383, -375]$.

E. $a \in [-3, 7], b \in [-12.1, -10.9], c \in [2, 15]$, and $r \in [3, 8]$.

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3. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{20x^3 - 75x^2 + 85x - 28}{x - 2}$$

A. $a \in [19, 21]$, $b \in [-115, -113]$, $c \in [309, 317]$, and $r \in [-661, -657]$.

B. $a \in [19, 21]$, $b \in [-55, -50]$, $c \in [27, 38]$, and $r \in [0, 5]$.

C. $a \in [38, 44]$, $b \in [-161, -150]$, $c \in [395, 404]$, and $r \in [-819, -814]$.

D. $a \in [38, 44]$, $b \in [5, 8]$, $c \in [93, 96]$, and $r \in [161, 167]$.

E. $a \in [19, 21]$, $b \in [-43, -32]$, $c \in [14, 16]$, and $r \in [0, 5]$.

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4. Factor the polynomial below completely, knowing that $x-4$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 9x^4 - 54x^3 + 47x^2 + 150x - 200$$

A. $z_1 \in [-1.2, 0.1]$, $z_2 \in [-0.13, 1.43]$, $z_3 \in [1.96, 2.19]$, and $z_4 \in [3.9, 4.01]$

B. $z_1 \in [-4.2, -2.8]$, $z_2 \in [-2.03, -1.86]$, $z_3 \in [-0.6, -0.42]$, and $z_4 \in [0.57, 0.63]$

C. $z_1 \in [-5.8, -4.5]$, $z_2 \in [-4.7, -3.58]$, $z_3 \in [-2.01, -1.7]$, and $z_4 \in [0.47, 0.59]$

D. $z_1 \in [-2.4, -1.3]$, $z_2 \in [0.99, 1.68]$, $z_3 \in [1.96, 2.19]$, and $z_4 \in [3.9, 4.01]$

E. $z_1 \in [-4.2, -2.8]$, $z_2 \in [-2.03, -1.86]$, $z_3 \in [-1.89, -1.42]$, and $z_4 \in [1.56, 1.72]$

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5. Factor the polynomial below completely, knowing that $x-2$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 6x^4 - 59x^3 + 206x^2 - 304x + 160$$

A. $z_1 \in [-4.28, -3.72]$, $z_2 \in [-2.11, -1.43]$, $z_3 \in [-0.78, -0.37]$, and $z_4 \in [-0.51, 0.3]$

B. $z_1 \in [-4.28, -3.72]$, $z_2 \in [-3.23, -2.11]$, $z_3 \in [-2.42, -1.97]$, and $z_4 \in [-2.07, -1.17]$

C. $z_1 \in [1.03, 1.82]$, $z_2 \in [0.92, 2.24]$, $z_3 \in [2.38, 2.55]$, and $z_4 \in [3.29, 4.43]$

D. $z_1 \in [-0.57, 0.96]$, $z_2 \in [-0.13, 1.04]$, $z_3 \in [1.89, 2.08]$, and $z_4 \in [3.29, 4.43]$

E. $z_1 \in [-4.28, -3.72]$, $z_2 \in [-4.06, -3.6]$, $z_3 \in [-2.42, -1.97]$, and $z_4 \in [-0.89, -0.61]$

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6. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{6x^3 - 2x^2 - 44x + 45}{x + 3}$$

A. $a \in [5, 9]$, $b \in [-23.4, -18.2]$, $c \in [15, 18]$, and $r \in [-5, 1]$.

B. $a \in [-19, -17]$, $b \in [49.5, 54.2]$, $c \in [-209, -197]$, and $r \in [644, 649]$.

C. $a \in [-19, -17]$, $b \in [-58.6, -53.9]$, $c \in [-217, -210]$, and $r \in [-594, -589]$.

D. $a \in [5, 9]$, $b \in [15.1, 16.8]$, $c \in [-1, 11]$, and $r \in [53, 60]$.

E. $a \in [5, 9]$, $b \in [-27, -25.5]$, $c \in [59, 63]$, and $r \in [-195, -187]$.

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7. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 15x^3 - 89x^2 + 62x + 40$$

A. $z_1 \in [-3.5, -1.5]$, $z_2 \in [0.64, 0.8]$, and $z_3 \in [4.8, 5.4]$

B. $z_1 \in [-5, -4]$, $z_2 \in [-0.87, -0.74]$, and $z_3 \in [2.1, 2.9]$

C. $z_1 \in [-5, -4]$, $z_2 \in [-2.05, -1.27]$, and $z_3 \in [0.3, 0.5]$

D. $z_1 \in [-5, -4]$, $z_2 \in [-0.29, -0.11]$, and $z_3 \in [1, 2.3]$

E. $z_1 \in [-1.4, 1.6]$, $z_2 \in [0.97, 1.36]$, and $z_3 \in [4.8, 5.4]$

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8. What are the *possible Rational* roots of the polynomial below?

$$f(x) = 5x^4 + 3x^3 + 6x^2 + 2x + 6$$

A. $\pm 1, \pm 5$

B. All combinations of: $\dfrac{\pm 1, \pm 5}{\pm 1, \pm 2, \pm 3, \pm 6}$

C. $\pm 1, \pm 2, \pm 3, \pm 6$

D. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 3, \pm 6}{\pm 1, \pm 5}$

E. There is no formula or theorem that tells us all possible Rational roots.

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9. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{10x^3 - 30x + 18}{x + 2}$$

A. $a \in [-20, -19], b \in [39, 42], c \in [-116, -107], \text{ and } r \in [237, 239].$

B. $a \in [6, 14], b \in [-34, -29], c \in [58, 61], \text{ and } r \in [-164, -161].$

C. $a \in [6, 14], b \in [-23, -13], c \in [8, 15], \text{ and } r \in [-7, 1].$

D. $a \in [-20, -19], b \in [-42, -39], c \in [-116, -107], \text{ and } r \in [-202, -197].$

E. $a \in [6, 14], b \in [14, 23], c \in [8, 15], \text{ and } r \in [36, 42].$

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10. What are the *possible Integer* roots of the polynomial below?

$$f(x) = 5x^3 + 4x^2 + 3x + 4$$

A. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 4}{\pm 1, \pm 5}$

B. All combinations of: $\dfrac{\pm 1, \pm 5}{\pm 1, \pm 2, \pm 4}$

C. $\pm 1, \pm 5$

D. $\pm 1, \pm 2, \pm 4$

E. There is no formula or theorem that tells us all possible Integer roots.
